Unit-4 Business Statistics and Research Methods

"Statistics", that a word is often used, has been derived from the Latin word 'Status' that means a group of numbers or figures those represent some information of our human interest.

Statistics is a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data.

> ***According to A.L. Bowley*** *"Statistics are numerical statements of facts in any department of enquiry placed in relation to each other."*

> ***According to Webster*** *"The classified facts respecting the condition of the people in a state- especially those facts which can be stated in numbers or in tables of numbers or in any tabular or classified arrangement."*

> ***According to Croxton and Cowden*** *"Statistics may define as collection, presentation, analysis and interpretation of numerical data"*

Thus, we can say that Statistics is concerned with scientific method for collecting, organizing, summarizing, presenting and analysis data as well with drawing valid conclusion to make various decision in the field of management and related areas.

1. Research

Meaning of Research

Research in common way of speaking, refers to a search for knowledge. One can also define research as a scientific and systematic search for collecting information on a specific topic. Research is an art of scientific investigation.

> ***According to The Advanced Learner's Dictionary*** *of Current English lays down the meaning of research as "a careful investigation or inquiry specially through search for new facts in any branch of knowledge."*

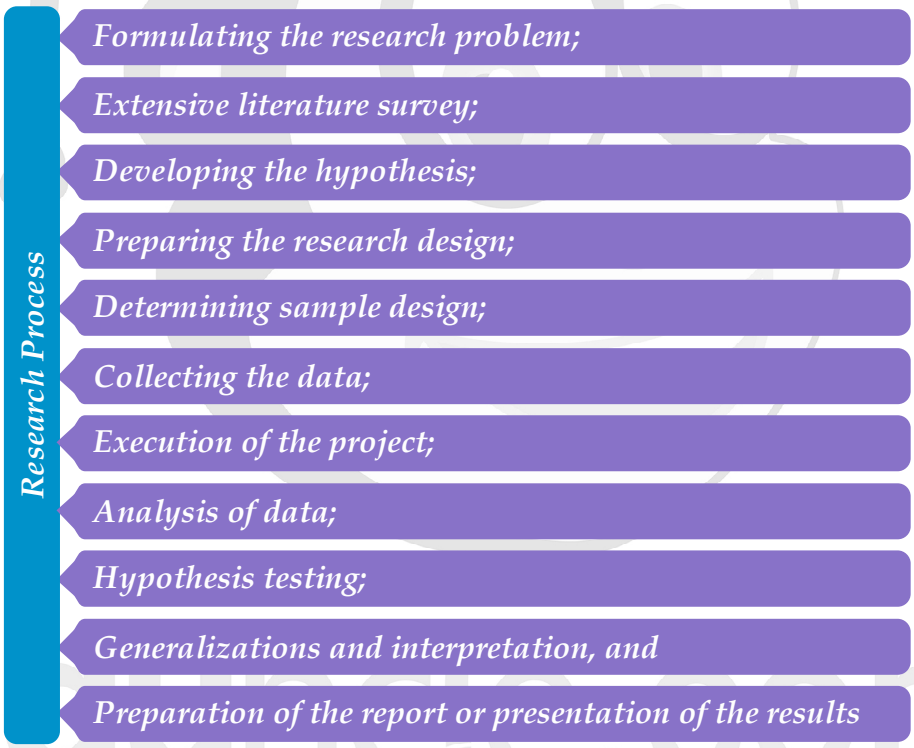
> ***According to Redman and Mory*** *research as a "systematized effort to gain new knowledge."*

> ***According to Clifford Woody*** *"Research Comprises defining and redefining problems, formulation hypothesis or suggested solution, collecting, organizing and evaluating data, making deduction and reaching conclusions and at last carefully testing to conclusions to determine whether they fit formulating hypothesis"*

Therefore an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. In short, the search for knowledge through objective and systematic method of finding solution to a problem is research. The systematic approach concerning generalization and the formulation of a theory is also research.

Objectives of Research

- *To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formative research studies)*
- *To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies)*
- *To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies)*
- *To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).*



Types of Research

The basic types of research are as follows :

(i) Descriptive vs. Analytical : ***Descriptive research*** *includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present.* In social science and business research we quite often use the term Ex post facto research for descriptive research studies. The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening. Most ex post facto research projects are used for descriptive studies in which the

researcher seeks to measure such items as, for example, frequency of shopping, preferences of people, or similar data. Ex post facto studies also include attempts by researchers to discover causes even when they cannot control the variables. The methods of research utilized in descriptive research are survey methods of all kinds, including comparative and correlational methods. *In **analytical research**, on the other hand. The researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material.*

(ii) Applied vs. Fundamental : ***Applied research*** *aims at finding a solution for an immediate problem facing a society or an industrial/business organisation, whereas fundamental research is mainly concerned with generalisations and with the formulation of a theory.* Gathering knowledge for knowledge's sake is termed **fundamental research**. Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research. Similarly, research studies, concerning human behaviour carried on with a view to make generalisations about human behaviour, are also examples of fundamental research. However, research aimed at certain conclusions facing a concrete social or business problem is an example of applied research. Research to identify social, economic or political trends that may affect a particular institution, marketing research, evaluation research are examples of applied research. Thus, the central aim of applied research is to discover a solution for some pressing practical problems, whereas basic research directed towards finding information that has a broad base of application and thus, adds to the already existing organized body of scientific knowledge.

(iii) Quantitative vs. Qualitative : ***Quantitative research*** *is based on the quantitative measurements of some characteristics. It is applicable to phenomena that can be expressed in terms of quantities. Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind.* For instance, when we are interested in investigating the reasons for human behaviour (i.e., why people think or do certain things), we quite often talk of 'Motivation Research ' , an important type of qualitative research. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose. Other techniques of such research are word association tests, sentence completion tests, story completion tests and similar other projective techniques. Attitude or opinion research i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research. **Qualitative research** is specially important in the behavioural sciences where the aim is to discover the underlying motives of human behaviour. Through such research we can analyse the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply for qualitative research in practice is relatively a difficult job and therefore, while doing such research, one should seek guidance from experimental psychologists.

(iv) Conceptual vs. Empirical : ***Conceptual research*** *is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. On the other hand, empirical research relies on experience or observation alone, often without due regard for system and theory.* It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research it is necessary to get facts at firsthand, at their source, and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results. He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Such research

is thus characterised by the experimenter's control over the variables under study and his deliberate manipulation of one of them to study its effects. **Empirical research** is appropriate when proof is sought that certain variables affect other variables in some way. Evidence gathered through experiments or empirical studies are considered to be the most powerful support possible for testing a given hypothesis.

(v) Some Other Types of Research : All other types of research are variations of one or more of the above stated approaches, based on either the purpose of research, or the time required to accomplish research, on the environment in which research is done, or on the basis of some other similar factors. Form the point of view of time, we can think of research either as one-time research or **longitudinal research**. In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods. Research can be **field-setting research or laboratory research** or **simulation research**, depending upon the environment in which it is to be carried out. Research can as well be understood as **clinical or diagnostic research**. Such research follow case-study methods or indepth approaches to reach the basic casual relations. Such studies usually go deep into the causes of things or events that interest us, using very small samples and very deep probing data gathering devices. The research may be **exploratory** or it may be formalized. The objective of **exploratory research** is the development of hypotheses rather than their testing, whereas formalized research studies are those with substantial structure and with specific hypotheses to be tested. **Historical research** is that which utilizes historical sources like documents, and archeological remains etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time.

Research Design

Meaning of Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

Need For Research Design

Research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money. Just as for better, economical and attractive construction of a house, we need a blueprint (or what is commonly called the map of the house) well thought out and prepared by an expert architect, similarly, we need a research design or a plan in advance of data collection and analysis for our research project.

Features of a Good Design

A good design is often characterised by adjectives like flexible, appropriate, efficient, economical and so on. Generally, the design which minimises bias and maximises the reliability of the data collected and analysed is considered a good design. *The design which gives the smallest experimental error is supposed to be the best design in many investigations.*

A research design appropriate for a particular research problem, usually involves the consideration of the following factors :

(i) the means of obtaining information;
(ii) the availability and skills of the researcher and his staff, if any;
(iii) the objective of the problem to be studied;
(iv) the nature of the problem to be studied; and
(v) the availability of time and money for the research work.

Important Concepts Relating to Research Design

Dependent and Independent Variables

A concept which can take on different quantitative values is called a variable. As such the concepts like weight, height, income are all examples of variables. Qualitative phenomena (or the attributes) are also quantified on the basis of the presence or absence of the concerning attribute(s). Phenomena which can take on quantitatively different values even in decimal points are called 'continuous variables', but all variables are not continuous. If they can only be expressed in integral values, they are non-continuous variables or in statistical language 'discrete variables'. "Age is an example of continuous variable, but the number of children is an example of non-continuous variable. If one variable depends upon or is a consequence of the other variable, it is termed as a dependent variable, and the variable that is antecedent to the dependent variable it is termed as an independent variable.

Extraneous Variable

Independent variables that are not related to the purpose of the study, but may affect the dependent variable are termed as extraneous variables.

Control

The technical term 'control' is used when we design the study minimising the effects of extraneous independent variables.

Confounded Relationship

When the dependent variable is not free from the influence of extraneous variable(s), the relationship between the dependent and independent variables is said to be confounded by an extraneous variable(s).

Research Hypothesis

The research hypothesis is a predictive statement that relates an independent variable to a dependent variable.

Experimental and Non-Experimental Hypothesis-Testing Research

Research in which the independent variable is manipulated is termed 'experimental hypothesis-testing research' and a research in which an independent variable is not manipulated is called 'non-experimental hypothesis-testing research'.

Experimental and Control Groups

In an experimental hypothesis-testing research when a group is exposed to usual conditions, it is termed a 'control group', but when the group is exposed to some novel or especial condition, it is termed as 'experimental group'.

Treatments

The different conditions under which experimental and control group are put usually referred to as 'treatments'.

Experiment

The process of examining the truth of a statistical hypothesis, relating to some research problem, is known as an experiment.

Experimental Unit(s)

The pre-determined plots or the blocks, where different treatments are used, are known as experimental units. Such experimental units must be selected (defined) very carefully.